Davis and Los Angeles, CA

March 9, 2017

Mr. Dan Ray, Chief Executive Officer, and Members
Delta Stewardship Council
980 9th Street, Suite 1500
Sacramento, CA 95814

Subject: Comments on revised Chapter 7

Dear Mr. Ray and Members of the Delta Stewardship Council,

We are writing to you regarding revised Chapter 7 edits discussed at the February Delta Stewardship Council meeting. In general, we find the edits encouragingly reflective of available science. However, we have important comments on two subject areas; earthquake and subsidence impacts on levees. In summary, we find that it should not be assumed that the earthquake hazard in the Delta was previously overestimated and that the increased probability of levee failure due to continuing subsidence should be considered and studied further.

From lines 268 – 274 of Revised Chapter 7, Earthquake Effects

"The DWR Delta Risk Management Strategy Phase 1 study evaluated the performance of Delta levees under various seismic threat scenarios, and analyzed potential consequences for water supply, water quality, ecosystem values, and public health and safety. The study concluded that a major earthquake of magnitude 6.7 or greater in the vicinity of the Delta Region has a 62 percent probability of occurring sometime between 2003 and 2032 (DWR 2009). More recent investigations suggest earthquake-induced ground shaking affecting Delta levees may be less serious, but still worrisome (Delta Independent Science Board 2016; Deverel. 2016)."

Comments

Clarification is needed here. The referenced text in the above excerpt describing earthquake-induced shaking came from The Delta Independent Science Board 2016 Workshop Report which stated the following. "A DRMS study a decade ago used attenuation equations that were considered state of the art at the time. These equations have now been found to overestimate Bay Area transmission of ground motions by factors of two to four in the case of the 2014 South Napa earthquake of magnitude 6.0, and also for smaller Bay Area earthquakes."

The data from the Napa earthquake and smaller Bay Area earthquakes does not necessarily dictate what will happen in the Delta and it is premature to reach conclusions on Delta ground motion attenuation rates based on limited data sets. Deverel et al. (2016a) stated it thusly: "Ground motions during the Napa earthquake were observed to attenuate more quickly with distance than predicted by the ground motion models used in the DRMS study (Erdem et al. 2016). Currently, it is unclear whether the rapid attenuation was a specific characteristic of the Napa event, or whether it is a more general characteristic of ground motions in the region". Deverel et al. (2016a) provided a map of estimated ground motions for the Delta (Figure 8 in their paper) for 10% probability of exceedance in 50 years and identified the

seismic sources controlling the ground shaking hazards. This work found that much of the hazard in the Delta comes from the local faults at close distance, so attenuation over large distances (as examined by others in the Napa studies) is perhaps of secondary importance. Moreover, this work found high hazard levels in the region, not dissimilar to the previous work, and concluded that the anticipated ground motion levels ".... are sufficient to induce ground failure in levee fills and underlying foundation soils".

Another noteworthy consideration is that there is large uncertainty in the site amplification models for the Delta, particularly under strong shaking levels. Such effects appreciably impact seismic hazard estimates regardless of source location and require further investigation to improve the reliability of future seismic risk investigations.

In light of these considerations, we should not assume that the earthquake hazard in the Delta was previously overestimated.

Comments on Lines 2350 through 2390, Science and Information Needs

In addition to the needs listed in this section, we recommend additional seismic and subsidence related science and information needs. In addition to the current recommendations, seismic hazard analysis should consider 1) spatial attenuation with due consideration for epistemic uncertainty, and 2) quantify uncertainty in site response.

A more complete understanding of subsidence rates throughout the Delta and how levees are affected by subsidence will aid in developing and prioritizing subsidence mitigation. Deverel et al. (2016b) estimated subsidence rates throughout the Delta where there are organic soils based on the available data for land-surface elevation changes and greenhouse gas emissions. These estimates can be improved through better characterization of the distribution of soil organic carbon content (a key determinant of subsidence) and additional measurement. Remote sensing techniques such as those described in Sharma et al. (2016) may also be helpful if proper ground field data collection is employed for validation.

How subsidence affects levee stability will also benefit from more quantitative evaluation. Deverel et al. (2016a) demonstrated the increased probability of levee failure due to continuing subsidence and the benefits of subsidence mitigation provided by wetlands and rice cultivation. Additional analysis and field measurement will provide more quantitative information about how subsidence affects levee stability.

Thank you for the opportunity to provide comment.

Sincerely,

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References

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